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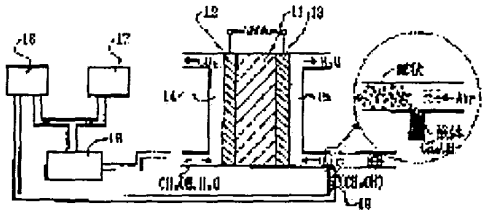
(54) LIQUID FUEL CELL

(57)Abstract:
PURPOSE: To provide a liquid fuel cell which has a simple structure and little energy loss and excellent motive properties.

CONSTITUTION: Methanol is generally supplied to a fuel chamber 14 from a methanol tank 16 but at the time of starting a liquid fuel cell, methanol is supplied directly to an air chamber 15. As a result, since methanol is directly fired in an air electrode 13, the temperature of the whole liquid fuel cell rises rapidly and the cell can be operated at the optimum operation temperature within a short time.



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Translation of JP 05-307970

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CLAIMS

[Claim(s)]
[Claim 1] The liquid fuel cell characterized by providing the following. the negative electrode which receives supply of fuel, and the positive electrode which receives supply of oxygen -- this -- the fuel cell cell which has the electrolyte inserted in inter-electrode [two] The tank which stores a fuel content solution. The pump which supplies a fuel content solution from this tank to the negative electrode of the aforementioned fuel cell cell. The bulb which controls sending out of the fuel content solution from the blower which supplies the gas which is arranged in the ventilation flue which is open for free passage to the aforementioned positive electrode, and contains oxygen from the exterior to the aforementioned positive electrode, and the aforementioned tank to the fuel content solution supply way which connects in the ventilation flue between the aforementioned blower and a positive electrode and the aforementioned fuel content solution supply way from the aforementioned tank.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the good liquid fuel cell of starting nature.
[0002]
[Description of the Prior Art] The conventional liquid fuel cell is explained based on a drawing. awing 1 is the conceptual diagram of the conventional liquid fuel cell, for example, shows the liquid fuel cell at the time of using a methanol as fuel. The methanol pole 2 which is a negative electrode, and the air pole 3 which is a positive electrode have countered mutually through an electrolyte 1, for example, sulfuric-acid solution. The tooth back of the methanol pole 2 serves as a combustion chamber 4, and the fuel which consists of water by which adjustment mixture was carried out, and a methanol is supplied to predetermined concentration with the pump 9 from the water tank 8 and the methanol tank 7. On the other hand, it has the air chamber 5 where air is supplied to the tooth back of an air pole 3 by the blower.
[0003] A methanol-water mixed solution is decomposed on the methanol pole 2, and they are carbon-dioxide-gas CO2, hydrogen ion H+, and Electron e. - It becomes. If a chemical formula shows this, it will become like the following formula (1).
[0004]
[Formula 1]

[0005] Furthermore, electron e generated on the meta-no pole 2 - An air pole 3 is reached through an external circuit 6, and it is aforementioned hydrogen ion H+. And it reacts with the oxygen in an air chamber 5, and water is generated. The generated water is discharged from an air chamber 5. If a chemical formula shows this, it will become like the following formula (2).
[0006]
[Formula 2]

[0007]
[Problem(s) to be Solved by the Invention] Conventionally, generally compared with the power supply of others [fuel cell / nature / starting], it is said that it is bad. This cause is because the cell performance of a fuel cell is mainly greatly influenced by operation temperature. This inclination has appeared notably in the liquid fuel cell which used the liquid as fuel. For example, the relation between current density and potential showed the single cell performance of the methanol fuel cell at the time of considering as the temperature of 60 degrees C, and 25 degrees C at drawing 4 . In addition, it is 2MH2 SO4 about the electrolytic solution in this case. It carried out and fuel was set to 2MCH3 OH. the case where a single cell performance compares so that drawing 4 may show -- a room temperature (25 degrees C) -- 0.4V and 24mA/cm2 it is -- a thing -- receiving -- 60 degrees C -- 0.4V and 59 mA/cm2 Current density is increasing and only the performance below a

half is obtained compared with the case of 60 degrees C at the room temperature.
[0008] Namely, at low temperature, if an electrochemical reaction is slow, current density is small, and for the reason output voltage becomes low and makes it an elevated temperature, an electrochemical reaction will become early and, for the reason, output voltage will become [current density] large highly. Therefore, when a liquid fuel cell is started at a room temperature, before reaching the operating temperature for obtaining the optimal current density, time will be taken, and starting nature is bad.
[0009] In order to cope with such a problem, a liquid fuel cell and a dc-battery are hybridized and the method compensated with insufficient power until a liquid fuel cell carries out a temperature up and a predetermined performance is obtained with a dc-battery, and the method which adds an electrical heater to a liquid fuel cell, and carries out a temperature up to predetermined temperature compulsorily are proposed. There are some which are indicated by JP,1-187776,A as latter technology.
[0010] However, by these methods, since equipment is complicated that the whole equipment is enlarged in order to add a dc-battery and an electrical heater, and for such auxiliary machinery and another energy is required, there is a problem of loss of energy etc. as a whole. Then, in view of the above-mentioned trouble, this invention is easy structure, does not almost have energy loss, and aims at realizing the good liquid fuel cell of starting nature.
[0011]
[Means for Solving the Problem] In order to solve said trouble, this invention the negative electrode which receives supply of fuel, and the positive electrode which receives supply of oxygen -- this -- with the fuel cell cell which has the electrolyte inserted in inter-electrode [two] The tank which stores a fuel content solution, and the pump which supplies a fuel content solution from this tank to the negative electrode of the aforementioned fuel cell cell, The blower which supplies the gas which is arranged in the ventilation flue which is open for free passage to the aforementioned positive electrode, and contains oxygen from the exterior to the aforementioned positive electrode, It considers as the liquid fuel cell characterized by having the bulb which controls sending out of the fuel content solution from the aforementioned tank to the fuel content solution supply way connected to the ventilation flue between the aforementioned blower and a positive electrode from the aforementioned tank, and the aforementioned fuel content solution supply way.
[0012] By supplying little fuel to a positive electrode directly in the during starting of a fuel cell, fuel will burn directly and will generate heat in a positive electrode. For this reason, a fuel cell reaches predetermined temperature from starting for a short time, and it can operate with the optimal operating temperature. The reaction formula by the methanol in an air pole burning directly is shown by the following formula (3).
[0013]
[Formula 3]

[0014]
[Example 1] The liquid fuel cell of this example 1 is explained based on a drawing. Drawing 2 is the conceptual diagram of the liquid fuel cell of this example 1, and shows the example at the time of using a methanol especially as fuel. The methanol pole 12 is constituted by the so-called gas diffusion electrode, and consists of a gas supply layer and a reaction layer.

The methanol solution supplied to this methanol pole 12 produces the reaction of the following formula (1).
[0015]
[Formula 4]

[0016] Moreover, in an air pole 13, the reaction of the following formula (2) is produced by the oxygen contained in the air ventilated by the blower, and the electron which moved by short-circuiting the hydrogen ion and positive/negative pole which reached the air pole 13 through the electrolyte through a load etc.
[0017]
[Formula 5]

[0018] And the fuel cell cell consists of a methanol pole 12, an air pole 13, and an electrolyte 11. The methanol pole 12 which is a negative electrode, and the air pole 13 which is a positive electrode have countered mutually through an electrolyte 11, for example, sulfuric-acid solution. The mixed-solution room of a pump 18 is open for free passage through the electric rotary pump, respectively, and it is made to function as an opening-and-closing bulb by controlling the operation of this electric rotary pump, and un-operating from a water tank 17 and the methanol tank 16. The tooth back of the gas supply layer of the methanol pole 12 serves as a combustion chamber 14, and the fuel of methanol solution is supplied to a combustion chamber 14 by the operation of a pump 18 from the mixed-solution room of a pump 18. The methanol solution supplied to the above-mentioned combustion chamber 14 passes along the passage which is not illustrated, and returns to the mixed-solution room of a pump 18 again. And the electric rotary pump which is open for free passage in the mixed-solution room of a pump 18 from the above-mentioned water tank 17 and the methanol tank 16, respectively is controlled so that the concentration of the methanol solution supplied to the methanol pole 12 turns into predetermined concentration.
[0019] From the aforementioned methanol tank 16, piping for supplying a methanol to an air chamber 15 directly further is given, and when a bulb 19 is opened by the during starting of a liquid fuel cell, with an airstream, a methanol becomes fog-like and is supplied to an air chamber 15. Therefore, since a methanol burns directly in an air pole 13, the exothermic reaction of the aforementioned formula (3) occurs and a liquid fuel cell reaches predetermined temperature, for example, 50-60 degrees C. At this time, a bulb 19 is closed and it usually operates as a liquid fuel cell.
[0020] The above-mentioned bulb 19 is also constituted by the electric rotary pump, and it is made to function as an opening-and-closing bulb by controlling the operation and un-operating. In addition, control of the methanol amount of supply of during starting is performed by controlling time energizing the above-mentioned pump from during starting by the timer. In this case, the temperature sensor which is not illustrated detects the ambient temperature of the cell of an electrolyte 11 or a fuel cell, and you may make it change the time which operates this pump based on this detection temperature. In addition, in this example 1, although the methanol is supplied to the air pole 13 through a bulb 19 from the methanol tank 16, you may supply a methanol through a bulb 19 from the mixed-

solution room of a pump 18.

[0021] Thus, in addition to the composition of the conventional liquid fuel cell, the liquid fuel cell of this example 1 is only what laid piping from the methanol tank 16 to the air chamber 15 side, and the composition is very simple.

[0022]

[Example 2] The liquid fuel cell of this example 2 is explained based on a drawing. Drawing 3 is the conceptual diagram of the liquid fuel cell of this example 2, in the liquid fuel cell in an example 1, adds piping to an electrolyte 21 further from the methanol tank 26, and supplies a methanol to an electrolyte 21. Other composition is the same as an example 1.

[0023] Open a bulb 30, supply a methanol to an electrolyte 21, direct combustion of the methanol in an air pole 23 is made to perform, and predetermined temperature is made to carry out the temperature up of the liquid fuel cell for a short time in the during starting of this liquid fuel cell at the same time it opens a bulb 29 to an air chamber 25 and supplies a methanol to it in the shape of a fog with air. As mentioned above, although the fuel cell of this invention explained what mainly used the methanol as fuel, this invention is not limited to a methanol fuel cell, but can be applied to various liquid fuel cells.

[0024]

[Effect of the Invention] There is almost no energy loss which the temperature up at the time of starting takes, structure is easy and the good liquid fuel cell of the starting nature which carries out a temperature up for a short time can be offered.

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Translation of JP 06-188008

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CLAIMS

[Claim(s)]
[Claim 1] While providing the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and these two electrodes and using liquid fuel as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack At least one field arranged at the flow of the aforementioned oxidizer gas and parallel is met among the peripheral faces of the aforementioned stack, including the end face of the aforementioned fuel electrode. The fuel cell characterized by constituting in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas so that the liquid fuel introduction way where the aforementioned liquid fuel touches directly may be established in the end face of the aforementioned fuel electrode and the aforementioned liquid fuel may be supplied to it by the capillary force of the porosity object used as the aforementioned fuel electrode at the aforementioned fuel electrode.
[Claim 2] The fuel cell according to claim 1 characterized by preparing the oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly to the field adjacent to the aforementioned oxidizer pole of the aforementioned fuel electrode.
[Claim 3] The fuel cell according to claim 1 characterized by preparing the oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly to the aforementioned oxidizer pole.
[Claim 4] The aforementioned liquid fuel is a fuel cell according to claim 1 characterized by being introduced from a fuel storage tank by the capillary force of the aforementioned liquid fuel introduction way.
[Claim 5] The fuel cell according to claim 1 characterized by forming the oxide skin in the front face of the capillary tube section which supplies the aforementioned liquid fuel to the aforementioned fuel electrode by the capillary force.
[Claim 6] The aforementioned fuel electrode is a fuel cell according to claim 1 characterized by being constituted by the fuel oxidation-catalyst particle which made the

fuel oxidation catalyst exist in the shape of an island without lapping in general mutually on the support of heat-resistant acid resistance, and made the proton conductivity matter of heat-resistant acid resistance exist in the front face of the aforementioned fuel oxidation catalyst at least.

[Claim 7] While providing the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and two electrodes through separator and using liquid fuel as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack The oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly is established in the field adjacent to the aforementioned oxidizer pole of the aforementioned separator. And at least one field arranged at the flow of the aforementioned oxidizer gas and parallel is met among the peripheral faces of the aforementioned stack, including the end face of the aforementioned fuel electrode. While the aforementioned liquid fuel establishes the liquid fuel introduction way which touches directly in the end face of the aforementioned fuel electrode and supplies the aforementioned oxidizer gas in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas through the aforementioned oxidizer gas supply slot at it The fuel cell characterized by constituting so that the aforementioned liquid fuel may be supplied to this fuel electrode by the capillary force of the porosity object used as the aforementioned fuel electrode.

[Claim 8] The fuel cell according to claim 7 characterized by preparing the liquid fuel supply slot where opening of the end was carried out to the field which touches the aforementioned fuel electrode of the aforementioned separator towards the aforementioned liquid fuel introduction way,

[Claim 9] The aforementioned liquid fuel is a fuel cell according to claim 7 characterized by being introduced from a fuel storage tank by the capillary force of the aforementioned liquid fuel introduction way.

[Claim 10] The fuel cell according to claim 7 characterized by forming the oxide skin in the front face of the capillary tube section which supplies the aforementioned liquid fuel to the aforementioned fuel electrode by the capillary force.

[Claim 11] The aforementioned fuel electrode is a fuel cell according to claim 7 characterized by being constituted by the fuel oxidation-catalyst particle which made the fuel oxidation catalyst exist in the shape of an island without lapping in general mutually on the support of heat-resistant acid resistance, and made the proton conductivity matter of heat-resistant acid resistance exist in the front face of the aforementioned fuel oxidation catalyst at least.

[Claim 12] It is the fuel cell characterized by binding the aforementioned stack tight at least with the material the direction of a laminating indicates rubber elasticity to be in the fuel cell possessing the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and these two electrodes.

[Claim 13] The electromotive section which a fuel cell becomes from the electrolyte layer mainly pinched by a fuel electrode, an oxidizer pole, and these two electrodes, The 1st water absorption means which absorbs the water produced from the oxidizer pole in which it consisted of recovery meanses of the water generated on the oxidizer pole of a fuel-supply

means to supply fuel to the aforementioned electromotive section, and the aforementioned electromotive section, and got down, and the aforementioned water recovery means was prepared in contact with the oxidizer pole, It is the fuel cell to which the 1st water absorption means established in contact with the water absorption means of the above 1st consists of the 2nd water absorption means which absorbs the water which carries out absorption maintenance, and the water absorption means of the above 2nd is characterized by being set up so that water absorptance may serve as size rather than the water absorption means of the above 1st.
[Claim 14] the electromotive section which consists of an electrolyte layer pinched by a small fuel cell, a fuel electrode, an oxidizer pole, and these two electrodes -- two or more -- connection -- the fuel cell characterized by to have the structure where of a conductor connects in series, and fuel is supplied from a fuel path common to the fuel electrode of each electromotive section, and the electrode side of the fuel electrode of each power-generation section faces the aforementioned fuel path, and for the aforementioned electrolyte layer to contain the absorptivity matter or the water-retention matter
[Claim 15] It is the fuel cell characterized by having the mechanism to which the aforementioned fuel cell carries out polarization of the fuel electrode anodicly in the fuel cell which consists of an electrolyte layer pinched by a fuel electrode, an oxidizer pole, and these two electrodes.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention relates to a fuel cell, especially the fuel cell suitable for the miniaturization.
[0002]
[Description of the Prior Art] Since efficiency of a fuel cell is good as an independent power

plant, it attracts attention recently. A fuel cell is divided roughly into the phosphoric acid fuel cell which uses gas as fuel, a fused carbonate fuel cell, a solid oxide fuel cell, an alkaline electrolytic-solution type fuel cell, etc. a methanol fuel cell, a hydrazine fuel cell that use a liquid as fuel, etc. Since these fuel cells are aimed at the source of power for mainly moving the generator for power, and a large-sized device, a compressor, a pump, etc. for introducing the fuel of gas or a liquid or oxidizer gas in a cell are required for them, and it is not only complicated as a system, but they consume power for these introduction.

[0003] If the methanol fuel cell using the methanol as liquid fuel is explained as an example, in the system of a methanol fuel cell, fuel will be sent to the main part of a cell with a pump from a methanol tank, and the air which is an oxidizer will be sent to the main part of a cell by the blower. For example, in order [which is the methanol and electrolyte which especially serve as fuel as dissolution fuel by this cell] to feed a mixed liquor object with a dilute sulfuric acid on the main part of a cell with a pump through a methanol controller or an acid controller, the system is much more complicated. Such complexity is the same about other fuel cells, and a blower and a pump are needed in order to send fuel and oxidizer gas by any system. Such system complexity is because it is aimed at mass power by the present fuel cell as the object for power, a source of power of a large-sized device, etc., in order to attain this, a lot of fuel and oxidizer gas must be passed, and therefore, a pump, a blower, etc. are needed.

[0004] On the other hand, as a social trend, various devices, such as OA equipment, audio equipment, and a walkie-talkie machine, are miniaturized with development of semiconductor technology, and portable nature is demanded further. As a source of power generation for satisfying such a demand, an easy primary cell, an easy rechargeable battery, etc. are used. However, a primary cell and a rechargeable battery have a limit in a function top time, and, naturally a time is limited in OA equipment using such a cell. When these cells are used, after electric discharge of a cell finishes, a time is [as opposed to / the weight / with the primary cell of what can exchange cells and can move OA equipment etc.] short, and it is unsuitable for a portable device. Moreover, if electric discharge finishes with a rechargeable battery, while it can charge, there is a fault a service space is not only restricted, but that a power supply is required because of charge, and charge takes time. Even if electric discharge of a cell finishes especially as OA equipment incorporating the rechargeable battery, as for a limit of the time of eye a difficult hatchet and a device, **** does not have [exchanging cells] ** at it. Thus, in order to operate various small devices for a long time, correspondence is difficult and extension of the conventional primary cell and a rechargeable battery requires the cell suitable for the more nearly prolonged operation.

[0005] There is a fuel cell which was mentioned above as one solution of such a problem. Since it has the advantage it not only has the advantage that it can generate electricity only by supplying fuel and an oxidizer, but that it can generate electricity continuously if fuel is exchanged, a fuel cell can be called system very advantageous to the operation of small devices, such as OA equipment with small power consumption, if a miniaturization is possible.

[0006] Since air can be used for a fuel cell as an oxidizer, although a limit is received from a viewpoint of an oxidizer neither in a service space nor a time, although power consumption, such as OA equipment, is small when using gas as fuel, if the density of gas is considered,

the capacity which power generation takes is large and unsuitable for the miniaturization of a cell. On the other hand, compared with gas, density of liquid fuel is high, and it is overwhelmingly advantageous as fuel of the fuel cell for small devices. Therefore, if the fuel cell using liquid fuel can be miniaturized, the power supply for small equipments in which the prolonged operation which is not in the former is possible is realizable. As mentioned above, in order to send liquid fuel into the main part of a cell, in the system using the conventional liquid fuel, that a pump is complicated as a system and is miniaturized with structure with this since the blower etc. is required in order to send in oxidizer gas again has an obstacle when realizing such a power supply for small equipments in a difficult thing.

[0007] Furthermore, the gas supplied to the cell by the pump or the blower in a phosphoric acid fuel cell, a fused carbonate fuel cell, and the conventional fuel cells, such as a solid oxide fuel cell, is further introduced into each electrode through the gas channel adjoined and prepared in the oxidizer pole and the fuel electrode. In this case, from a viewpoint of passing a lot of fuel gas and oxidizer gas so that a load may be given to neither a pump nor a blower, the gas passageway of a gas channel is made into the shape of a big quirk so that a pressure loss may not arise as much as possible. For example, at the gas channel of a fused carbonate fuel cell, it is usual. The slot of the depth which exceeds 2mm is formed. Also by the fuel cell using liquid fuel like a methanol fuel cell, this is the same, differs in the phosphoric acid fuel cell mentioned [especially] above by the methanol fuel cell, and serves as a still bigger value than the case where gas is used as fuel about a pressure loss in order to pass a mixture with the methanol which is an electrolyte and which becomes a sulfuric acid and fuel, for example at an electrolyte layer and a fuel electrode. in order that [thus,] the conventional fuel cell may send in gas and a liquid by the pump or the blower -- the shape of a quirk of a gas channel -- large -- not carrying out -- it does not obtain, but when the shape of a quirk is conversely made small, in extension of old technology -- a pump and a blower become large -- a miniaturization has the problem that it cannot attain

[0008] A point which was mentioned above is coped with and the liquid fuel cell (refer to JP,59-66066,A) which used the capillary force for supply of liquid fuel is proposed as a fuel cell which aimed at correspondence to a miniaturization. This liquid fuel cell is the capillary force of the vas-capillare material which made the base material synthetic fibers, such as organic [, such as paper, cotton, asbestos, and glass,] or inorganic fiber material, and an acrylic, nylon, and is a cell of the parallel flow method which sucks up to ** on the other hand toward the upper part from the fuel stockroom which prepared liquid fuel in the lower part, and supplies an anode, and passes oxidizer gas in the same direction as the supply direction of fuel. By this cell, while establishing a fuel stockroom in the lower part, in order to pass oxidizer gas perpendicularly, the intake of gas is required for the lower part of a cell, therefore it has structure which prepared the crevice between the fuel stockroom and the stack base. Moreover, the component consists of fiber which has flexibility which was mentioned above so that a part of vas-capillare material may be narrowed down mechanically and supply of fuel can be controlled by this method. Furthermore, this cell has the structure where vas-capillare material which was mentioned above and which was electrically constituted from an insulating material was embedded so that it might stick to some anode side charge collectors with a charge collector.

[0009] Although the above-mentioned liquid fuel cell fits a miniaturization rather than the

conventional fuel cell in order to supply liquid fuel to a fuel electrode by the capillary force, two or more problems are included and those improvements are called for. For example, in the anode (fuel electrode), although liquid fuel penetrates or permeates horizontally, it has the restrictions on the structure where capillarity is not shown, in the direction of facing up, as indicated by the above-mentioned official report. Moreover, by the cell of this method, as mentioned above, since it is the structure where a crevice inserts a fibrous vas-capillare material required between a stack base and a fuel stockroom at a fuel stores dept., while the seal of vas-capillare material and a fuel stockroom becomes difficult, you have to make it the structure which unifies a stack and a fuel stockroom and is fixed. And structure not only becomes complicated, but it must prepare two or more entrances for introducing vas-capillare material into the fuel stockroom upper part on the occasion of unification, and the manufacture has the fault of being very difficult. If it furthermore says, in order to pass an oxidizer, in this fixed structure, it complicates structure that it is also necessary to open a slit in a part for the oxidizer polar zone at the base of a stack at least.

[0010] Moreover, since liquid fuel is supplied to the upper part by Mukai's capillarity on the other hand from the lower part as mentioned above, time will receive restrictions in the configuration of a cell in this top that fuel is supplied to the upper part of a fuel electrode. That is, although it is necessary to enlarge area of electromotive parts, such as an electrode and an electrolyte plate, in order to enlarge current, when a limit exists in height like this method, the width of face of electromotive parts is come size, and a kink colander is not obtained, but restrictions arise in a cell configuration. Furthermore, by this cell, since an insulating vas-capillare material is embedded at the part in the charge collector by the side of a fuel electrode, the electron obtained as a result of the cell reaction has the fault of not obtaining a flow colander, but the path for which the electrical and electric equipment not only concentrates, but the electrical and electric equipment flows becoming long about a charge collector, and producing an electric loss.

[0011] On the other hand, in order to improve contact between cell parts by the conventional high power and the fuel cell of a large area about bolting of a cell and to aim at improvement in a performance, the large-sized clamping device which the force joins uniformly was used. For example, the cell area of a commercial phosphoric acid fuel cell or a fused carbonate fuel cell is 2 5000-10000cm about. In order to bind this tight so that contact between parts may become good, it is 15-30ton in general. You have to bind tight with the equipment which has a bolting load. Therefore, each clamping device used for the conventional fuel cell is complicated and large-scale equipment, and is not suitable for the fuel cell which is going to attain a miniaturization.

[0012] There is a problem of removal of the water which, on the other hand, generates the system of the conventional fuel cell as a resultant on an electrode front face as one of the factors to complicate. Although it is one electrode in a fuel cell and water arises as a product of electrode reaction, it is necessary to remove this water from an electrode front face. Piling up in the electrode front face which is a product bars supply of the matter which should be supplied, and it reduces reaction efficiency as a result.

[0013] Since especially the solid-state polyelectrolyte type fuel cell using proton conductivity films, such as perfluorocarbon sulfonic acid (tradename : product made from Nafion:Du Pont), as an electrolyte operates at low temperature (room temperature -100 degree C) comparatively, although it is expectable as a power supply for small devices In

the fuel cell which operates at such low temperature 100 degrees C or less, since the water produced on the oxidizer pole generates in the state of a liquid, the problem of stay of the water on the front face of an electrode will become much more serious that it is hard to vaporize.

[0014] In the conventional fuel cell, prepared the air supply duct in the side of the main part of a cell, have arranged the air jet pipe to the opposite side, generation water was made to dew the wall surface of this air jet pipe, and generation water was collected. The schematic diagram of the conventional fuel cell is shown in drawing 42 .

[0015] That is, as shown in drawing 42 , the air discharge duct 84 is installed in the air supply duct 83 which attached the blower 82 in the side of the fuel cell main part 81, and its opposite side, the generation water recovery duct 54 is formed in the bottom of this air discharge duct 84, and it contains in the cell case 57 in which the air entrance 86 and the air outlet 87 opened these. Air supply is performed by the blower 82, the air containing generation water is sent in the air discharge duct 84, the generation water which generation water dewed the internal surface of this air discharge duct 84, and dewed it is collected by the lower generation water recovery tank 85, and discharge air is discharged outside through an air outlet 87.

[0016] If the above recovery methods of generation water are applied to a small fuel cell which is expected, it becomes impossible to disregard the volume of the drive power of the blower itself, or a blower, and the advantages, such as a high charging efficiency and a small thing, will be lost. Although the recovery method of generation water is otherwise proposed, it is necessary to supply the energy equivalent to heat of vaporization, and energy efficiency does not become good theoretically by the method of making generation water once evaporating.

[0017] Therefore, the mechanism in which the water generated from an oxidizer pole is removed is needed, without using special power and special energy, in order to realize a small fuel cell.

[0018] On the other hand, there is a problem on the structure as another factor which complicates the system of a fuel cell.

[0019] The general laminated structure is shown by making a phosphoric acid fuel cell into an example at drawing 43 . In this case, the electric conduction board 39 called separator or interchange connector between the electromotive sections which consist of the oxidizer pole 38, an electrolyte layer 36, and a fuel electrode 37 was placed, by this, each electromotive section was connected in series and required voltage is secured. This structure is applied to the solid-state polyelectrolyte type fuel cell etc. not only at a phosphoric acid fuel cell but at a fused carbonate fuel cell and a pan. In the fuel cell of such structure, the air as the fuel supplied to the cell using the pump, the blower, etc. or an oxidizer is introduced into each electrode through the separator which adjoined the oxidizer plate and the fuel-electrode board and was formed. In this case, the gas passageway of separator or an electrode board is made into the shape of a quirk which has a certain amount of depth so that a pressure loss may not arise as much as possible from a viewpoint of passing reacting matters, such as a lot of fuel and oxidizer gas, so that a load may be given to neither a pump nor a blower. When especially liquid fuel, such as a methanol, is used, in order to pour the fuel of a liquid unlike the phosphoric acid fuel cell mentioned above, about a pressure loss, it becomes a still bigger value than the case where

gas is used as fuel.
[0020] Thus, since it is necessary to form a slot etc. in separator etc. as passage of this reacting matter, the fuel cell of the conventional structure cannot but take a certain amount of thickness, and volume occupied other than the reaction catalyst of the electrolyte layer which is the original power generation section, fuel, and an oxidizer pole, and a charge collector must be enlarged. Though the electrode board or separator which acts as passage is thinly made small, in order to supply a reacting matter through narrow passage in this case, a burden cannot but start a pump, a blower, etc., and those mechanisms must be enlarged.
[0021] The volume occupied other than the reaction catalyst of the electrolyte layer which is the original electromotive section, a fuel electrode, and an oxidizer pole, and a charge collector since it is such is stopped as small as possible, two or more electromotive sections are arranged in horizontal **** at right angles to the thickness direction as a policy which attains the miniaturization of the whole fuel cell, and how to connect so that it may become in-series mutually at the edge can be considered. In this case, since it can perform supply of a reacting matter, and recovery of a product from one space and it is not necessary to two or more electromotive sections separator not only to become unnecessary, but to give the function as passage to an electrode board, there is no abbreviation and it can be made thin. Such a view is already indicated by JP,63-141266,A, JP,63-141270,A, etc.
[0022] However, a problem as shown below arises in the fuel cell of such composition.
[0023] In the usual fuel cell, the object contained in an electrolyte layer, and an electrolyte and a steam of the same kind are mixed in the reacting matter supplied in order to compensate an outflow and evaporation of the component in the electrolyte from an electrolyte layer or to prevent dryness.
[0024] Especially, since water flows from a fuel electrode with ion to an oxidizer pole at the time of operation, the solid-state polyelectrolyte type fuel cell using proton conductivity films, such as the above-mentioned perfluorocarbon sulfonic acid (tradename : product made from Nafion Du Pont), etc. as an electrolyte runs short of the moisture by the side of a fuel electrode gradually, and efficiency falls. Therefore, into the fuel supplied to a fuel electrode, in the case of liquids, such as a methanol, mixed the electrolyte of a liquid, the case of hydrogen gas made the steam mix, and it supplied.
[0025] On the other hand, generation of water takes place in the electrode of another side. In the above-mentioned solid-state macromolecule type fuel cell, in an oxidizer pole side, since the water which flows from a fuel electrode besides the water generated according to electrode reaction exists, moisture becomes superfluous.
[0026] The water mixed and supplied to such a reacting matter, and an electrolyte or the generated water combines and short-circuits between two or more power generation elements in ion, and becomes the cause which causes the fall of a cell voltage. The problem is remarkable if the above-mentioned water and an electrolyte exist in the state of a liquid especially.
[0027] Like the above-mentioned, two or more power generation elements are put in order lining up side-by-side, the fuel cell of composition of having connected the edge in series shares the supply space of fuel, and the recovery space of a product, and since an inter-electrode distance is short, the problem of such a voltage loss is much more serious.
[0028] The schematic diagram at the time of connecting with drawing 28 in series [put the

two power generation sections in order lining up side-by-side, and] is shown. As for a fuel electrode and 60, in drawing 28 , 37 is [an electrolyte layer and 38] oxidizer poles, and the two electromotive sections 55 are electrically connected in series by lead 57. The fuel electrodes 37a and 37b and oxidizer pole comrade of the two power generation sections adjoin each other. Both the power generation section can perform supply of fuel, and discharge of a product from one space. In drawing 28 , supply of fuel is performing supply of oxidizer gas from the fuel passage 58 in the oxidizer passage 59.

[0029] In this case, the electric potential gradient has arisen between fuel-electrode 37a of the one power generation section, oxidizer pole 38a of this power generation section, and fuel-electrode 37b of this potential. Moreover, the inclination of potential has arisen similarly between oxidizer pole 38a and oxidizer pole 38b.

[0030] If the matter which acts as an electrolyte exists in both the electromotive section front face 58, i.e., fuel passage, and the oxidizer passage 39 at this time, movement of ion will take place according to the above-mentioned electric potential gradient, this acts as the leakage current, and a voltage loss arises.

[0031] Therefore, two or more power generation sections are lined up side-by-side like the above, and it connects in series, and in attaining the miniaturization of a fuel cell according to the structure which makes common fuel-supply space and recovery space of a product, in order for the efficiency of a cell to fall by the voltage loss produced between each power generation section, it is necessary to reduce such a voltage loss.

[0032] As fuel generally supplied to a fuel cell on the other hand, there are gases, such as hydrogen gas, or liquids, such as a methanol and a hydrazine. Although power consumption, such as OA equipment, is small when using gas as fuel, if the density of gas is considered, the capacity which power generation takes is large and unsuitable for the miniaturization of a cell. On the other hand, compared with gas, density of liquid fuel is high, and it is overwhelmingly advantageous as fuel of the fuel cell for small devices. Therefore, if the fuel cell using liquid fuel can be miniaturized, the power supply for small equipments in which the prolonged operation which is not in the former is possible is realizable.

[0033] Since C1 - C2 compounds, such as a methanol and ethanol, are cheap and the boiling point is also moderately high also in liquid fuel, it can use easily from a safety aspect. However, there is development of an electrode catalyst as a technical difficulty in such a cell. That is, in the anodic oxidation of the fuel containing carbon like a methanol, platinum with high catalytic activity also serves as a practically serious trouble in order for poisoning by which the intermediate product of a reaction sticks to an electrode front face firmly with the passage of time to appear and to bring about the fall of large catalyst ability.

[0034] Although the electrode catalyst excellent in poisoning-proof nature is examined, it has come [therefore,] to acquire still sufficient property. Therefore, for the moment, the fuel cell from which it is stabilized and high power is obtained for a long time is not obtained. Therefore, in the case of the fuel cell using organic fuel, such as a methanol, it is necessary to suppress poisoning on the front face of an electrode.

[0035] As mentioned above, the fuel cell of a general conventional type has a complicated system, and the miniaturization has the problem of being difficult, with composition as it is. A miniaturization which is suitable for the power supply for small devices etc. on the other

hand since structure is complicated and the restrictions on structure also have it, although the conventional liquid fuel cell using the capillary force fits a miniaturization constitutionally is not attained. [much] Moreover, the correspondence to the miniaturization of a fuel cell is called for also about discharge of how to bind cell parts tight and the generated water, and connection between the electromotive sections. When liquid fuel is furthermore used, correspondence is called for also about poisoning on the front face of an electrode.

[0036]

[Problem(s) to be Solved by the Invention] this invention solved the above-mentioned technical problem in the above-mentioned conventional fuel cell, it was carried out in order to offer a small fuel cell useful as a power supply of a small device, and it is in offering the fuel cell which made it possible to miniaturize after maintaining high efficiency by simplifying structure while simplifying the distribution system of the 1st liquid fuel and oxidizer gas of the purpose of this invention.

[0037] It is in offering the fuel cell which performed discharge of the water generated with operation of the purpose of the 2nd fuel cell, without using special power and special energy, and was suitable for the miniaturization. Furthermore, the 3rd of the purpose suppresses the ionic conduction between the electromotive sections to the minimum, and even if it makes connection between the electromotive sections suitable for the miniaturization of a fuel cell, offering the fuel cell which was suitable for practical use enough few has a voltage loss. Furthermore, when liquid organic fuel, such as a methanol which was suitable as fuel used for a small fuel cell, is used, the 4th of the purpose stops poisoning produced on an electrode front face, and is to offer the fuel cell from which the output stabilized for a long time is obtained.

[0038]

[Means for Solving the Problem and its Function] The 1st fuel cell which it was carried out in order that this invention might attain the above-mentioned purpose, and is made simplification of the feeding system which is the 1st of the purpose While providing the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and these two electrodes and using liquid fuel as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack it has been arranged among the peripheral faces of the aforementioned stack at the flow of the aforementioned oxidizer gas, and parallel, including the end face of the aforementioned fuel electrode -- at least -- One field is met. It is characterized by constituting so that the liquid fuel introduction way where the aforementioned liquid fuel touches directly may be established in the end face of the aforementioned fuel electrode and this liquid fuel may be supplied in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas by the capillary force at the aforementioned fuel electrode.

[0039] While the 2nd fuel cell possesses the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and two electrodes through separator and liquid fuel is used for it as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack The oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly is established in the field adjacent

to the aforementioned oxidizer pole of the aforementioned separator. and it has been arranged among the peripheral faces of the aforementioned stack at the flow of the aforementioned oxidizer gas, and parallel, including the end face of the aforementioned fuel electrode -- at least -- One field is met. While the aforementioned liquid fuel establishes the liquid fuel introduction way which touches directly in the end face of the aforementioned fuel electrode and supplies the aforementioned oxidizer gas in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas through the aforementioned oxidizer gas supply slot at it It is characterized by constituting so that the aforementioned liquid fuel may be supplied to this fuel electrode by the capillary force of the porosity object used as the aforementioned fuel electrode.

[0040] Furthermore, while the 3rd fuel cell possesses the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and two electrodes through separator and liquid fuel is used for it as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack The oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly is established in the field adjacent to the aforementioned oxidizer pole of the aforementioned separator. and it has been arranged among the peripheral faces of the aforementioned stack at the flow of the aforementioned oxidizer gas, and parallel, including the end face of the aforementioned fuel electrode -- at least -- While preparing a liquid fuel introduction way in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas along one field While an end establishes the liquid fuel supply slot by which opening was carried out in the field which touches the aforementioned fuel electrode of the aforementioned separator and supplies the aforementioned oxidizer gas to it through the aforementioned oxidizer gas supply slot towards the aforementioned liquid fuel introduction way It is characterized by constituting the aforementioned liquid fuel from a capillary force of the aforementioned liquid fuel supply slot at least, so that this fuel electrode may be supplied.

[0041] Furthermore, while the 4th fuel cell possesses the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a fuel electrode, an oxidizer pole, and these two electrodes and liquid fuel is used for it as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack The oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly is established in the field adjacent to the aforementioned oxidizer pole of the aforementioned fuel electrode. and it has been arranged among the peripheral faces of the aforementioned stack at the flow of the aforementioned oxidizer gas, and parallel, including the end face of the aforementioned fuel electrode -- at least -- One field is met. While the aforementioned liquid fuel establishes the liquid fuel introduction way which touches directly in the end face of the aforementioned fuel electrode and supplies the aforementioned oxidizer gas in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas through the aforementioned oxidizer gas supply slot at it It is characterized by constituting so that the aforementioned liquid fuel may be supplied to this fuel electrode by the capillary force of the porosity object used as the aforementioned fuel electrode.

[0042] Furthermore, while the 5th fuel cell possesses the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate pinched by a

fuel electrode, an oxidizer pole, and these two electrodes and liquid fuel is used for it as fuel In the fuel cell constituted so that oxidizer gas might be perpendicularly passed along the laminating side of the aforementioned stack The oxidizer gas supply slot which passes the aforementioned oxidizer gas perpendicularly is established in the aforementioned oxidizer pole. and it has been arranged among the peripheral faces of the aforementioned stack at the flow of the aforementioned oxidizer gas, and parallel, including the end face of the aforementioned fuel electrode -- at least -- One field is met. While the aforementioned liquid fuel establishes the liquid fuel introduction way which touches directly in the end face of the aforementioned fuel electrode and supplies the aforementioned oxidizer gas in the direction which intersects perpendicularly with the flow of the aforementioned oxidizer gas through the aforementioned oxidizer gas supply slot at it It is characterized by constituting so that the aforementioned liquid fuel may be supplied to this fuel electrode by the capillary force of the porosity object used as the aforementioned fuel electrode.

[0043] Furthermore, in the fuel cell possessing the stack which carried out two or more laminatings of the electromotive section which has the electrolyte plate by which the 6th fuel cell was pinched by a fuel electrode, an oxidizer pole, and these two electrodes, the aforementioned stack is characterized by being bound tight with the material the direction of a laminating indicates rubber elasticity to be at least.

[0044] In the above fuel cell of this invention, since it constitutes so that oxidizer gas may be first passed perpendicularly to a stack, oxidizer gas can be passed effectively. Moreover, a liquid fuel introduction way is prepared in the direction which intersects perpendicularly with the flow of oxidizer gas along with the stack peripheral face arranged at the flow of oxidizer gas, and parallel, and the positive supply by the capillary force of liquid fuel is attained, without checking the flow of oxidizer gas, since it constitutes so that the liquid fuel introduced in this liquid fuel introduction way may be supplied to a fuel electrode by the capillary force. Moreover, while being able to simplify structure, there are also few constitutional restrictions. Without using especially auxiliary parts, such as a pump and a blower, oxidizer gas and liquid fuel can be supplied smoothly, and these enable it to attain a miniaturization therefore.

[0045] The fuel cell by which the discharge method of the generation water which is the 2nd purpose of this application has been improved has the following composition.

[0046] namely, a fuel electrode and an oxidizer pole -- and the power-generation section which has the electrolyte layer pinched by these two electrodes, the 1st porous body which absorb the water which it is prepared in contact with an oxidizer pole, and produces from an oxidizer pole, and the 2nd porous body which absorb the water which it is prepared in contact with the 1st porous body, and the 1st porous body holds are the fuel cells characterized by to be constituted so that average pore size may become small along the direction where water flows

[0047] For example, in the fuel cell using liquid fuel, such as a methanol, it operates as a fuel cell by the mechanism shown below.

[0048] Fuel, such as a methanol, is supplied to a fuel electrode and oxygen is supplied to an oxidizer pole. When a methanol is made into an example, the following reactions occur.

[0049] fuel-electrode (anode): -- CH3 OH+H2 O -> CO2+6 H++6 e oxidizer pole (cathode): 3/2O2+6 H++6 e -> 3 H2 O overall-reaction: -- CH3 OH+3 / 2O2 -> CO2+2 H2 O -- that is In a fuel electrode, a methanol carries out [water] a mol reaction, carbon dioxide gas and

a proton are produced, and a proton reacts with oxygen by the fuel electrode through a solid-state polyelectrolyte film, and generates three-mol water. In total, a methanol and oxygen react and two-mol water is generated. It is necessary to remove promptly the water generated at least to make such a reaction perform smoothly.

[0050] Moreover, when the power supply for small devices is assumed, it is necessary to perform this without special power.

[0051] Therefore, the structure of the oxidizer pole in the invention in this application prepares a porous body so that an oxidizer pole front face may be touched, or it makes the oxidizer pole itself a porous body, and absorbs the water produced to the oxidizer pole in the operation of the capillarity of a porous body. The oxidizer which a porous body with the vas-capillare force stronger than the oxidizer pole itself which consists of the porous body or porous body prepared so that recovery of water might furthermore touch an oxidizer pole front face, i.e., average pore size, becomes from the porous body or porous body prepared so that an oxidizer pole front face might be touched in a porous body smaller than the aforementioned porous body is made to contact. Thereby, water is smoothly removed from an oxidizer pole front face.

[0052] Especially this invention is effective if the water generated on the oxidizer pole applies to the fuel cell which operates at the temperature which is a liquid, i.e., the temperature of about 100 degrees C or less. That is, the water absorption by the capillarity of a porous body is for acting effectively, when water is a liquid.

[0053] As fuel cell about 100 degrees C or less, there are an alkali type fuel cell and the phosphoric acid fuel cell under a special service condition, a solid-state polyelectrolyte type fuel cell, etc. [temperature / operation] It is suitable, when especially the solid-state polyelectrolyte used for a solid-state polyelectrolyte type fuel cell consists of a high molecular compound which has ion-exchange ability, what formed this in the shape of a film does not have the spill of the electrolytic solution, and mixture of the reacting matter of an anode and a cathode is prevented, and a fuel cell system is miniaturized and it is simplified. Although the solid-state poly membrane of proton conductivity has put in practical use in the present condition, you may use an anion conducting film.

[0054] Moreover, when the miniaturization of a fuel cell is taken into consideration, as fuel, use of hydrogen gas etc. is possible. For example, you may use the hydrogen gas by which occlusion was carried out to the hydrogen storing metal alloy. However, it is desirable practically to use fuel like alcohols like the methanol which is a liquid, and ethanol, a hydrazine, or an amine acid in ordinary temperature.

[0055] The fuel cell with few voltage losses between the electromotive sections which are the 3rd of the purpose of this application has the following composition. Namely, it has the electromotive section which has the electrolyte layer pinched by a fuel electrode, oxidizer poles, and these electrodes. Two or more electromotive sections are connected in series, and fuel is supplied from the fuel passage where the fuel electrode of each electromotive section is common. And the electrode side of the fuel electrode of each electromotive section faces the aforementioned fuel passage, or an oxidizer is supplied from the oxidizer passage where the oxidizer pole of each electromotive section is common. And in the fuel cell of the structure where the electrode side of the oxidizer pole of each electromotive section faces the aforementioned oxidizer passage, it is characterized by the aforementioned electrolyte layer containing absorptivity or the water retention object.

[0056] That is, in the above fuel cell, the thing which made the absorptivity which moisture is supplied and held inside [other than the compound which has the ion-exchange capacity which is the main constituent of the usual electrolyte as an electrolyte layer of the electromotive section] a film, or can pass moisture according to a concentration gradient, or the water retention matter coexist is used.
[0057] While maintaining the electrolyte layer which starts this invention as mentioned above at the state where the water generated on one electrode catalyst front face is absorbed promptly, and the active substance can always be contacted in a catalyst front face in order to show absorptivity or water retention himself, the absorbed water diffuses the inside of an electrolyte according to a concentration gradient, and the work which prevents dryness on the front face of an electrode of another side also shows it. The outstanding property in which the electrolyte itself can furthermore maintain ionic dissociation effective have [no addition of the moisture from the outside] always and an ionic conduction property in this process is shown.
[0058] Therefore, in the fuel layer using this electrolyte layer, since the water which could supply water into the electrolyte, without making water mix into the reacting matter to supply, and was produced on the oxidizer pole is absorbed promptly, it can suppress ionic conduction other than an electrolyte layer small.
[0059] As the absorptivity concerning this invention, or water retention matter, gel compounds, such as water-absorbing-polymer compounds, such as starch, an acrylonitrile copolymer, a bridge formation acrylate, and a bridge formation polyethylene oxide, a silica hydrogel, and conversion protein (gelatin), etc. can be used.
[0060] Moreover, in the case of a solid-state polyelectrolyte, as an electrolyte, the remarkable effect of the invention in this application is acquired. as a solid-state polyelectrolyte -- as a proton conductivity solid-state polyelectrolyte -- perfluorocarbon-sulfonic-acid polymer (tradename: -- the cation exchange membrane of the polystyrene system which has a Nafion (product made from U.S. Du Pont) sulfonic group is mentioned)
[0061] By using such the electromotive section, the fuel cell which is the composition of more than an unescapable mixing grain having not contained the matter which acts as an electrolyte into any [of the reacting matter supplied to the oxidizer pole and fuel electrode which are the main point of this invention], and having connected the edge of two or more electromotive sections in series mutually is realizable.
[0062] Next, in order to prevent the method, and the mixture and the leakage current of a reacting matter which carry out the direct file of the charge collector of each power generation element by welding, the electroconductive glue, etc. as a method of connecting mutually the edge of two or more power generation elements in series, in case the method of connecting through an electric conduction board etc. or the power generation section is produced, the method of making unify so that a series connection may be carried out beforehand, and producing two or more power generation sections etc. can be adopted.
[0063] Furthermore, in order to suppress the leakage of an electrolyte in these methods, it is also effective to give a part for the connection of two or more electromotive sections a water-repellent finish.
[0064] Next, the fuel cell for stopping poisoning produced on the electrode front face which is the 4th of the purpose of this application is characterized by having the mechanism to which polarization of the fuel electrode is carried out anodicly in the fuel cell equipped with

the electrolyte layer pinched by a fuel electrode, an oxidizer pole, and these two electrodes.
[0065] That is, in this invention, when the poisoning product on the front face of a fuel electrode arises at the time of operation of a fuel cell, a counter electrode is connected to a fuel electrode, polarization is carried out anodicly, and oxidization removal of the aforementioned poisoning product is carried out. The fuel cell from which the output stabilized for a long time is obtained by that cause is obtained.
[0066] In the fuel cell, two or more electromotive sections which consist of a fuel electrode, an oxidizer pole, and an electrolyte are further usually connected and used for the serial. In this case, it is desirable to perform the aforementioned polarization operation as rotation for every electromotive section. A poisoning product can be removed without this interrupting operation.
[0067]
[Example] Hereafter, the embodiment of this invention is explained. First, the fuel cell miniaturized by the simplification of the distribution system of the liquid fuel and oxidizer gas which are the 1st of the purpose of this application, and the row by simplification of structure after carrying out efficient maintenance is explained.
[0068] drawing 1 shows the important section composition of the fuel cell of one example -- it is a notching perspective diagram in part In this drawing, 1 is the electrolyte plate pinched by the fuel electrode (anode) 2 and the oxidizer pole (cathode) 3, and the electromotive section 4 is constituted by these electrolyte plates 1, the fuel electrode 2, and the oxidizer pole 3. Here, a fuel electrode 2 and the oxidizer pole 3 are formed with the conductive porosity object so that it may let an electron pass while they circulate fuel and oxidizer gas.
[0069] And the stack 6 used as the main part of a cell is constituted by carrying out two or more laminatings of the electromotive section 4 which was described above through separator 5. This stack 6 is installed so that the laminating side of the electromotive section 4 may become parallel to a perpendicular direction fundamentally. In addition, the above-mentioned separator 5 is formed of a conductive material in order to also achieve the function of the collecting electrode plate which conducts the generated electron. Although stratified, the shape of an island, and the catalyst bed of granular ** may furthermore be formed between a fuel electrode 2, the oxidizer pole 3, and an electrolyte plate 1 if needed, this invention does not receive restrictions in the existence of such a catalyst bed. Moreover, it is good also considering fuel-electrode 2 and oxidizer pole 3 the very thing as a catalyst electrode.
[0070] Here, in the fuel cell of this invention, in order to pass oxidizer gas, for example, air, effectively, without needing power, it is necessary to consider as the structure where oxidizer gas flows perpendicularly to a stack 6. Oxidizer gas will flow very smoothly with the heat generated as a result of producing a cell reaction by passing oxidizer gas toward the upper part especially from the lower part of a stack 6. Then, in this example, the oxidizer gas supply slot 7 which passes oxidizer gas perpendicularly (the inside of drawing, the direction of z) is established in the field adjacent to the oxidizer pole 3 of separator 5 as a continuation slot.
[0071] Moreover, since [remarkable] it is small compared with a liquid, if the balance of liquid fuel required for a cell reaction and oxidizer gas is considered, as for the density of gas, it is advantageous to make it the structure which increases supply of oxidizer gas from

supply of liquid fuel because of the miniaturization of efficiency, a performance, as a result a cell. Although it becomes so advantageous that the cross section of the oxidizer gas supply slot 7 is enlarged, if an electric touch area will become small, a loss will arise, if a flute width is enlarged too much in order to enlarge the slot cross section, and the depth is made deep too much, electrode thickness or the thickness of separator 5 will become thick, and will become disadvantageous for a miniaturization from this viewpoint. Moreover, if the cross section of a slot is made small and the number of slots is made [many], the pressure loss of the oxidizer gas in the gas supply slot 7 will become large, and it will become difficult to pass oxidizer gas smoothly. Therefore, as width of face of a slot 7, about 0.2-2mm has about 0.5-20 desirablemm as the depth of a slot 7 again. In addition, the configuration of these oxidizer gas supply slot 7 shall be determined in consideration of the supply method of fuel gas mentioned later.

[0072] As mentioned above, the separator 5 in this example has the function as a channel to pass oxidizer gas. Thus, by using the parts 5 (it being hereafter described as channel combination separator) which have the function of both separator and a channel, part mark can be cut down more and it becomes possible to attain a miniaturization further. In addition, it is also possible to replace with the above-mentioned separator 5 and to use the usual channel.

[0073] The channel combination separator 5 which was described above may be formed with a metal plate without a hole, and may be a porosity object and just separates liquid fuel and oxidizer gas. In addition, when using a porosity object, it is desirable to close one [at least] hole of the field by the side of the fuel electrode of the channel combination separator 5 and the field by the side of an oxidizer pole so that liquid fuel may not trespass upon the oxidizer pole 3. Furthermore, in order to improve the flow of oxidizer gas, as for the aperture of the channel combination separator 5 which consists of a porosity object, it is desirable to set up more greatly than the aperture of the porosity object used as the oxidizer pole 3.

[0074] Furthermore, the form of the oxidizer gas supply slot 7 can also use the channel combination separator 8 which bent and processed the sheet metal with a press, rolling, etc., as restrictions are not received especially if conditions which were mentioned above are satisfied, and shown in drawing 2 . Such separator 8 can establish the continuation slot 9 also in a fuel-electrode 2 side while the oxidizer gas supply slot 7 is established in the oxidizer pole 3 side. Moreover, while establishing the oxidizer gas supply slot 7 in the channel combination separator 5 (8), it is also possible to establish the slot which passes oxidizer gas perpendicularly also in the oxidizer pole 3.

[0075] the liquid fuel introduction way 10 is formed in at least one above-mentioned side of a stack 6 along this field -- as -- fuel introduction way composition -- the member 11 is installed And the liquid fuel (mixed liquor object with the methanol which is usually an electrolyte and which serves as a dilute sulfuric acid and fuel, for example) introduced in the above-mentioned liquid fuel introduction way 10 is supplied to a fuel electrode 2 by the capillary force from the side of a stack 6. Here, if the liquid fuel introduction way 10 is established in the upper part or the lower part of a stack 6 in case oxidizer gas is passed toward the upper part from the lower part, the structure of a stack 6 will become very complicated. Therefore, it is important for it to prepare in the direction (the inside of drawing, x directions) which intersects perpendicularly with the flow of oxidizer gas while

forming the liquid fuel introduction way 10 along either of four fields except the vertical side among the peripheral faces of a stack 6. Moreover, in order to supply the liquid fuel in the liquid fuel introduction way 10 to a fuel electrode 2 from the side of a stack 6 by the capillary force, on the other hand (for example, side 4a), two sides which consist of end faces of the electromotive section 4 among the four above-mentioned stack sides meet at least, and the liquid fuel introduction way 10 is formed. Namely, the above-mentioned liquid fuel introduction way 10 is formed in the direction which intersects perpendicularly with the flow of oxidizer gas along with at least one field 4a which is the field which consists of end faces of the electromotive section 4 among the peripheral faces of a stack 6, and a field containing the end face of a fuel electrode 2 when it puts in another way, and has been arranged at the flow of oxidizer gas, and parallel. Moreover, in order to supply liquid fuel to a fuel electrode 2 by the capillary force, liquid fuel introduced in the liquid fuel introduction way 10 is considered as composition which contacts the above-mentioned electromotive section end-face 4a directly.

[0076] Without checking the flow of oxidizer gas, the whole edge surface of a fuel electrode 2 can be made into the structure which touches liquid fuel, and these enable it to supply smoothly the liquid fuel in the liquid fuel introduction way 10 to a fuel electrode 2 by the capillary force. And since the fuel cell of this example is making the supply direction (the direction of z) of oxidizer gas, and the introductory direction to stack 6 end face of liquid fuel intersect perpendicularly fundamentally, while it can simplify structure, there are few restrictions on structure, and it becomes possible to miniaturize therefore.

[0077] in addition, the above-mentioned fuel introduction way composition -- the thing good also as as common as the bolting member of a stack 6 which it carries out and is established separately is also possible for a member 11 -- etc. -- especially the composition or material are not limited however, fuel introduction way composition -- the portion which touches the stack 6 side of a member 11 must be insulated in order to prevent the short circuit between cells this -- for example, fuel introduction way composition -- a member -- constituting 11 the very thing from an insulating material **** -- or fuel introduction way composition -- it carries out by making an insulating material intervene between a member 11 and a stack 6

[0078] Liquid fuel is introduced from the fuel storage tank to which the configuration of the liquid fuel introduction way 10 mentioned above abbreviated illustration fundamentally, and this introduced liquid fuel should just be supplied to a fuel electrode 2 by the capillary force. One of the methods of supplying liquid fuel to the liquid fuel introduction way 10 from a fuel storage tank is made to carry out natural fall of the liquid fuel of a fuel storage tank, and the method of introducing on the liquid fuel introduction way 10 is in it. This method can introduce liquid fuel into the liquid fuel introduction way 10 certainly, if the restrictions on the structure where a fuel storage tank must be prepared in a position higher than the upper surface of a stack 6 are removed. The method of being the capillary force of the liquid fuel introduction way 10, and drawing liquid fuel from a fuel storage tank as other methods, is mentioned. When according to this method it becomes unnecessary to make higher than the upper surface of a stack 6 the position of the fuel entrance established in the node 10 of a fuel storage tank and the liquid fuel introduction way 10, i.e., a liquid fuel introduction way, and it is combined with the above-mentioned natural falling method, there is an advantage that the installation of a fuel tank

can be set up free.
[0079] for giving a capillary force to the liquid fuel introduction way 10 -- the kind of liquid fuel, and fuel introduction way composition -- although it changes with quality of the materials of a member 11, it is desirable to set the crevice between the liquid fuel introduction ways 10 (for t to show among drawing) to about 0.2-5mm a possibility of producing the short supply of liquid fuel if the crevice t between the liquid fuel introduction ways 10 is set to less than 0.2mm -- it is -- moreover -- If it exceeds 5mm, a possibility that sufficient capillary force may not be obtained will arise. Furthermore, when the operation of a cell is stopped for a long period of time, if the liquid fuel in the liquid fuel introduction way 10 vaporizes and the odor accompanying vaporization etc. is vainly considered as a bird clapper, the smaller one is advantageous [liquid fuel / the volume of the liquid fuel introduction way 10]. Moreover, it also takes raising a capillary force into consideration, and, as for the crevice t between the liquid fuel introduction ways 10, it is more desirable to be referred to as 3mm or less.
[0080] However, in order to supply succeedingly smoothly the liquid fuel introduced into the liquid fuel introduction way 10 by the capillary force to a fuel electrode 2 by the capillary force, it is important to set up so that the capillary force to a fuel electrode 2 may become large from the capillary force of the liquid fuel introduction way 10. Furthermore, in order to raise the capillary force of the liquid fuel introduction way 10, you may arrange an insulating porosity object and insulating fiber to the interior. In this case, the crevice t between the above-mentioned liquid fuel introduction ways 10 may exceed 5mm. In addition, in accordance with the side of a stack 6, it is not limited to one, and the number of the liquid fuel introduction ways 10 can also form the liquid fuel introduction way 10 also in the stack side of another side.
[0081] Moreover, a fuel storage tank which was mentioned above can be made removable from the main part of a cell. It enables this to perform the operation of a cell continuously by exchanging fuel storage tanks for a long time. In this case, in order to operate equipment continuously also at the time of a changing battery, when a fuel storage tank is separated, fuel needs to remain in the cell. Such a fuel stores dept. is a feed zone to the liquid fuel introduction way 10 and a fuel electrode 2, or fuel-electrode 2 the very thing, and considering the swap time of a fuel storage tank, as for the amount of the fuel which remains, it is desirable to make equipment into the amount which can operate 1 minute or more at least. Moreover, the supply of liquid fuel on the liquid fuel introduction way 10 from a fuel storage tank is good also as composition which extrudes liquid fuel with natural fall which was mentioned above, the internal pressure in a tank, etc., and can also be considered as composition which pulls out fuel by the capillary force of the liquid fuel introduction way 10. In this case, although the outlet crevice between fuel storage tanks is not restrained in the crevice between the liquid fuel introduction ways 10 when based on the internal pressure in natural fall or a tank, when based on a capillary force, it is more desirable than the crevice between the liquid fuel introduction ways 10 to enlarge the outlet crevice between fuel storage tanks.
[0082] The liquid fuel introduced in the liquid fuel introduction way 10 by method which was mentioned above is supplied to a fuel electrode 2 by the capillary force. As a capillary force for drawing this liquid fuel in a fuel-electrode 2 side, the capillary force of the porosity object itself which serves as a fuel electrode 2 first is mentioned. the so-called

continuation with which the hole of the fuel electrode 2 which is a porosity object was made to connect when using such a capillary force -- the free passage which continued to other whole surface at least from the fuel-electrode 2 side by the side of the liquid fuel introduction way 10 while considering as the hole and controlling the aperture -- it also enables a longitudinal direction to supply liquid fuel by the capillary force smoothly by considering as a hole Moreover, there is a possibility that the amount of supply of fuel may decrease, so that the speed of supply of liquid fuel not only becomes slow, but it will become far from the liquid fuel introduction way 10 since a cell reaction advances intensively by the entrance side of liquid fuel, if cell area becomes large. In such a case, it is effective to establish the liquid fuel introduction way 10 also in the stack side of another side with which are satisfied of the conditions mentioned above.

[0083] The aperture of the porosity object used as a fuel electrode 2 etc. is 0.2-300 micrometers, after taking into consideration the crevice between the liquid fuel introduction ways 10 that what is necessary is just what can draw the liquid fuel in the liquid fuel introduction way 10, although not limited especially. Considering as a grade is desirable. Moreover, as for the volume of the hole used as the index of the continuity of the hole in a porosity object, it is desirable to consider as about 35 - 80%. It is 0.2 micrometers about an aperture. If it is made small, manufacture of a fuel electrode 2 becomes difficult, and it is 300 micrometers. If it exceeds, a capillary force will decline. moreover -- if the volume of a hole becomes under 35 % -- continuation -- since the amount of a hole becomes less and the closed holes increase in number, it becomes impossible to fully obtain a capillary force on the contrary -- if the volume of a hole exceeds 80% -- continuation -- manufacture becomes difficult, while it becomes weak in intensity, although the amount of a hole increases An aperture is 0.5-100 micrometers practical. As for the range and the volume of a hole, it is desirable to consider as 45 - 75% of range.

[0084] Moreover, in order to draw liquid fuel in a fuel electrode 2 by the capillary force, it is desirable to open at least one of the sides other than the side by the side of the liquid fuel introduction way 10 so that it may ****** by the liquid fuel in which the air in a fuel electrode 2 was drawn. However, as for the sides other than the field which the fuel electrode 2 described above, closing, when suppressing volatilization of liquid fuel is desirable.

[0085] As liquid fuel is shown not only in the capillary force of the porosity object itself which serves as the fuel electrode 2 mentioned above as a capillary force for drawing in a fuel-electrode 2 side but in drawing 3 , it is also possible to constitute so that the liquid fuel supply slot 12 may be established in the field which touches the fuel electrode 2 of the channel combination separator 5 horizontally (the inside of drawing, the direction of y) as a continuation slot and liquid fuel may be drawn in a fuel-electrode 2 side using the capillary force of this liquid fuel supply slot 12. In this case, the liquid fuel introduction way 10 shall be formed so that the open end section and liquid fuel of the liquid fuel supply slot 12 may touch directly at least. Moreover, it is also possible to use together the capillary force of the porosity object itself [used as the capillary force of the liquid fuel supply slot 12 and a fuel electrode 2].

[0086] Although the configuration of the above-mentioned liquid fuel supply slot 12 does not receive restrictions especially if a capillary force can be demonstrated, it needs to make the capillary force by the slot 12 at least smaller than the capillary force of a fuel electrode

2. Although the liquid fuel in the liquid fuel introduction way 10 is supplied in the liquid fuel supply slot 12, it becomes impossible to supply it to a fuel electrode 2, if the capillary force of a slot 12 is larger than that of a fuel electrode 2. Although the configuration of the liquid fuel supply slot 12 changes with wettability of the component of the channel combination separator 5, and liquid fuel, as for the width of face, it is desirable to consider as the range of 0.2-10mm.

[0087] If the width of face of the liquid fuel supply slot 12 exceeds 10mm, a capillary force will become small, the capillary force of a fuel electrode 2 will serve as a subject after all, and the meaning in which the liquid fuel supply slot 12 was formed will be lost. On the contrary, when the width of face of a slot 12 is set to less than 0.2mm, although a capillary force improves, a process that it is difficult for supply of liquid fuel to stop catching up with a cell reaction upwards, and to cut a slot with the usual process and special is needed. The same is said of the depth of flute, and it is desirable to consider as the range of 0.1-2mm as the depth of flute. When the depth of a slot 12 is especially made deep too much, a thick kink colander will not be obtained for the thickness of the channel combination separator 5, but, as a result, a miniaturization will be checked. Furthermore, since there is a possibility of it not only becoming useless, but vaporizing and emitting an odor with vaporization when supply of fuel is stopped, power generation is stopped and a lot of liquid fuel remains, as for the depth of flute, it is more desirable to be referred to as 1mm or less. Moreover, in order that the width of face of a slot may make [many] electric contact in addition to the same reason, it is more desirable to be referred to as 5mm or less, and it is 3mm or less desirably.

[0088] Moreover, when introducing liquid fuel into the liquid fuel introduction way 10 by the capillary force from a fuel storage tank as mentioned above since it is what draws liquid fuel by the capillary force from the liquid fuel introduction way 10, the above-mentioned liquid fuel supply slot 12 is set up so that the capillary force of the liquid fuel supply slot 12 may become large from the capillary force of the liquid fuel introduction way 10. the difference of such a capillary force -- fundamental -- the cross section of the liquid fuel introduction way 10 and the liquid fuel supply slot 12 and the component of separator 5, and fuel introduction way composition -- although decided by material of a member 11, it is desirably more desirable than the crevice t between the liquid fuel introduction ways 10 to make small either [at least] the width of face of the liquid fuel supply slot 12 or the depth Thus, the configuration of the liquid fuel supply slot 12 shall be set up after taking into consideration the configuration of the porosity object used as a fuel electrode 2, or the liquid fuel introduction way 10. Moreover, as for the configuration of the liquid fuel supply slot 12, it is desirable to set up so that it is necessary to also take into consideration the configuration of the oxidizer gas supply slot 7 for example, and the width of face and the depth of the oxidizer gas supply slot 7 may become about 1.1 to 20 times from it of the liquid fuel supply slot 12. They are about 1.2 to 10 times still more desirably.

[0089] The above-mentioned liquid fuel supply slot 12 must not necessarily be formed horizontally, and may be leaned and formed in 45 - 90 degrees toward a perpendicular direction (the direction of z). However, the formation field of the liquid fuel supply slot 12 becomes narrow, and it is desirable [so effective fuel-supply ways], when an inclination becomes large to make it 30 or less degrees as an inclination in order to decrease in number. In addition, it is not this limitation when establishing the liquid fuel introduction

way 10 in both sides of a stack 6.

[0090] Thus, since fuel can be simultaneously supplied also to the longitudinal direction of a fuel electrode 2 through a slot 12 while liquid fuel is supplied to a fuel electrode 2 from the whole edge surface of a fuel electrode 2 by establishing the liquid fuel supply slot 12 prolonged horizontally in the channel combination separator 5, it becomes possible to supply still more smoothly the liquid fuel in the liquid fuel introduction way 10 to a fuel electrode 2. It becomes possible to advance a cell reaction uniformly all over electromotive section 4 by this, and high efficiency can be attained. In addition, although the above-mentioned example explained what formed both the oxidizer gas supply slot 7 and the liquid fuel supply slot 12 in the channel combination separator 5, you may install a channel separately to a fuel electrode 2 and the oxidizer pole 3. In such a case, the conductive board which does not make gas penetrate is installed among both channels, or separation with liquid fuel and oxidizer gas is aimed at by closing the hole of the field of one [at least] channel etc. However, in order to enable curtailment of part mark, as a result much more miniaturization, it is desirable to make a channel serve a double purpose.

[0091] Moreover, the improvement in a capillary force is important in drawing liquid fuel in a fuel electrode 2 by the capillary force from the liquid fuel introduction way 10. A capillary force becomes so large that the crevice between capillary tube paths is small as mentioned above, and the wettability to the liquid fuel of a capillary tube path is large. Improvement of a capillary tube section front face which starts a capillary force from a viewpoint which enlarges wettability to the liquid fuel of a capillary tube path is effective, and it is effective to prepare an oxide skin especially in this front face. That is, it becomes remarkably large and the speed which draws liquid fuel in a cell not only becomes quick, but a capillary force can extend the range of liquid fuel by preparing an oxide skin in the inside of the liquid fuel supply slot 12 established in the porosity inside-of-the-body front face and the channel combination separator 5 of a fuel electrode 2. Thereby, even if the area of a fuel cell is large, it not only can respond now, but it can shorten the duration at the time of starting a cell. However, as for the above-mentioned oxide skin, it is desirable to form so that the void content of a porosity object may not be reduced. In the end face of the fuel electrode 2 which touches the liquid fuel introduction way 10 especially, it is important to make it not plug up the entrance of liquid fuel with formation of an oxide skin.

[0092] By the way, a fuel electrode 2 must conduct the electron generated as a result of the cell reaction. Therefore, the oxide skin prepared in fuel-electrode 2 front face must not check the above-mentioned electronic conduction. If the oxide skin prepared in a fuel electrode 2 is insulation, an oxide skin will be formed except for the front face of the field in contact with the separator 5 of a fuel electrode 2, a channel, etc. Moreover, when preparing an oxide skin in the liquid fuel supply slot 12, it limits to the internal surface and an oxide skin is formed.

[0093] Moreover, when introducing liquid fuel to the liquid fuel introduction way 10 by the capillary force, formation of an oxide skin is effective also about the internal surface of the liquid fuel introduction way 10.

[0094] The method of raising temperature in an oxidizing atmosphere and steam atmosphere, and oxidizing a metaled front face as the formation method of such an oxide skin, the method of processing with chemicals, such as alkali, etc. are mentioned. Moreover, removal of an oxide skin can perform the portion by the mechanical method, for example,

polishing, cutting, etc.

[0095] In each above-mentioned example, although the fuel cell which has the stack 6 which carried out the laminating of the electromotive section 4 through the channel combination separator 5 was explained, in the fuel cell of this invention, neither separator nor a channel is necessarily required. For example, as shown in drawing 4 , it is also possible to carry out direct two or more laminatings of the electromotive section 4 which pinched the electrolyte plate 1 on the fuel electrode 2 and the oxidizer pole 3, and to constitute a stack 13. Under the present circumstances, as shown in drawing 4 , the oxidizer gas supply slot 7 is perpendicularly formed in the field adjacent to the oxidizer pole 3 of a fuel electrode 2 as a continuation slot, and as shown in drawing 5 , it is perpendicularly formed in the field which touches the fuel electrode 2 of the oxidizer pole 3. Moreover, as shown in drawing 6 , you may establish the oxidizer gas supply slot 7 in the field which touches the electrolyte plate 1 of the oxidizer pole 3. Furthermore, the oxidizer gas supply slot 7 needs to be in contact with neither an electrolyte plate 1 nor a fuel electrode 2. Thus, oxidizer gas can be smoothly passed also by forming the oxidizer gas supply slot 7 in a fuel electrode 2 or the oxidizer pole 3 directly. In addition, the composition of those other than these, i.e., liquid fuel introduction way 10 grade, is considered as the same composition as the fuel cell of the example mentioned above. And since part mark are more reducible by considering as the above-mentioned composition, a miniaturization can be attained further.

[0096] Moreover, as described above, when considering as composition which a fuel electrode 2 and the oxidizer pole 3 meet with directly, it is necessary to prevent that liquid fuel is drawn in the oxidizer pole 3 from a fuel electrode 2. When liquid fuel is drawn in the oxidizer pole 3, it is because oxidizer gas stops being able to flow easily and a cell reaction will be checked. What is necessary is just to control the aperture of the porosity object which serves as the oxidizer pole 3 fundamentally in a size which does not draw liquid fuel by capillarity as a method of preventing invasion of liquid fuel to the above-mentioned oxidizer pole 3. However, the above-mentioned aperture may have to be made into a size which draws liquid fuel by capillarity depending on the device to apply. In such a case, what is necessary is just to close the hole of the field by the side of the oxidizer pole 3 of the porosity object used as a fuel electrode 2 irrespective of in any the oxidizer gas supply slot 7 shall be formed between the fuel electrode 2 or the oxidizer pole 3. However, although you may also close the hole of the field by the side of the fuel electrode 2 except the slot 7 of the oxidizer pole 3 when establishing the oxidizer gas supply slot 7 in the oxidizer pole 3, it is desirable for there to be a possibility that liquid fuel may trespass upon the oxidizer pole 3 through the side of the oxidizer gas supply slot 7, and to close the hole of the contact surface with the fuel electrode 2 of the oxidizer pole 3 and the side of the oxidizer gas supply slot 7 in this case.

[0097] the above -- the method of closing a hole with the plastic deformation which makes material which does not check a flow with a fuel electrode 2 and the oxidizer pole 3 the shape of a slurry, and applies it as a method of closing a hole, or processes polishing, grinding, etc. into the field concerned, and is produced on a porosity object in that case -- melting, the method of making it solidify, etc. are further mentioned in the field concerned by the electron beam or laser Moreover, when forming the oxidizer gas supply slot 7 in the oxidizer pole 3, it can prevent that liquid fuel trespasses upon the oxidizer pole 3 also by [which do not let liquid fuel pass to the interface of a fuel electrode 2 and the oxidizer pole 3

] inserting conductive material, such as a metal plate, for example.
[0098] By the way, each fuel cell of each above-mentioned example has structure which touches directly the edge of the oxidizer pole 3 and the edge of an electrolyte plate 1 whose liquid fuel in the liquid fuel introduction way 10 is a porosity object. When touching liquid fuel at the edge, liquid fuel is drawn in the oxidizer pole 3 by the capillary force, and the drawn liquid fuel makes the path of oxidizer gas blockaded since especially the oxidizer pole 3 cannot supply gas to an electrolyte plate 1 if it is not a porosity object. Therefore, liquid fuel needs to prevent entering from the edge of the oxidizer pole 3.
[0099] Prevention of invasion of liquid fuel to the oxidizer pole 3 should just control the aperture of the porosity object used as the oxidizer pole 3 fundamentally in a size which does not draw liquid fuel by the capillary force. However, the above-mentioned aperture may have to be made into a size which draws liquid fuel by the capillary force depending on the device to apply. Invasion prevention of the liquid fuel in such a case is performed by wearing the field adjacent to the liquid fuel introduction way 10 of closing the hole of the field by the side of the liquid fuel introduction way 10 of the oxidizer pole 3 ****, or the oxidizer pole 3 by the seal member etc. As these concrete methods, the side is covered with boards, such as a metal, an inorganic substance, ceramics, and the organic substance, a foil, a film, etc., for example, or these methods of applying independent or the end of a composite powder in the shape of a slurry etc. are illustrated. Moreover, it is also possible to apply the method of using the plastic deformation mentioned above, and melting and the method of making it solidify.
[0100] moreover, as a method which is wearing the side of the latter oxidizer pole 3 by the seal member, in using separator 5, a channel, etc., as shown in drawing 7 , it locates in the side of the oxidizer pole 3 and an electrolyte plate 1 -- as -- a fuel electrode 2 and the channel combination separator 5 -- a seal -- the method whose member 14 is pinched is mentioned in this case, a seal -- if the member 14 has electronic-conduction nature, since the short circuit between fuel electrodes 2 will take place and an output will no longer be obtained -- a seal -- a member 14 is formed with an insulating material in addition, a seal -- a member 14 must not necessarily be pinched between a fuel electrode 2 and the channel combination separator 5, and only the side of inserting between fuel electrodes 2 **** or the oxidizer pole 3 can also pinch it
[0101] moreover, in using neither separator nor a channel, it shows in drawing 8 -- as -- the seal same between fuel electrodes 2 -- pinching a member 14 -- the side of the oxidizer pole 3 -- a seal member -- a wrap -- things are made under the present circumstances, a seal -- only the side of the oxidizer pole 3 can also pinch a member 14
[0102] By the way, in the stack 6 (13) which carried out the laminating of the electromotive section 4, in order to secure the electric contact between the electromotive sections 4, you have to bind a stack 6 (13) tight. in this case, the above-mentioned seal -- the seal inserted between electromotive section 4 parts or the channel combination separator 5 (it is hereafter described as a stack component part) when having put in another way by constituting a member 14 from material which has rubber elasticity and the electromotive section 4 was bound tight -- while being able to obtain certainly the electric contact described above when a member 14 deformed in rubber elasticity, the seal effect of liquid fuel can be acquired
[0103]